CATALOG OF RECORDED EXPLORATION DRILLING AND MINE WORKINGS IN THE TRI-STATE ZINC-LEAD DISTRICT, MISSOURI, KANSAS, AND OKLAHOMA - INTERIM REPORT

BY L. C. BRICHTA AND E. T. PERKINS

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INTRODUCTION AND SUMMARY

The Tri-State zinc-lead catalog, compilation of which was initiated by the Bureau of Mines in August 1949, is designed to provide a continuing record of available drill-hole logs and maps of mine developments in the zinc-lead district in southwestern Missouri, southeastern Kansas, and northeastern Oklahoma. The maps and data thus preserved constitute a reservoir of factual information readily available to individuals and firms interested in planning mineral explorations, to Government agencies for formulating estimates or ore reserves, and to the mining industry in the district for general uses. The areas to be included in the catalog embrace the explored and mined tracts within 760,000 acres of the more active western part of the district.

The consensus among local mine operators, geologists, and mining engineers is that over 100,000 holes, costing more than $30,000,000, have been drilled in the district. Records of some of the early drilling and mine developments are destroyed or lost, but the Bureau of Mines has copies of about 47,500 drill-hole logs and is accumulating and recording on microfilm those that are currently available. As of May 1, 1954, the logs of approximately 28,000 drill holes had been microfilmed and are available for inspection at the Bureau of Mines office, Joplin, Mo.

Mined areas and locations of drill holes are recorded on standard half-section maps, of which 63 covering 38 whole and fractional sections aggregating about 18,100 acres in Kansas and Oklahoma have been completed and indexed and are available for inspection at Bureau of Mines offices in Joplin and Rolla, Mo. The standard mapping and indexing systems, with mapping progress to May 1, 1954, are described in this interim report.

ACKNOWLEDGMENTS

The generous assistance and cooperation of the many mine operators and property owners in the district is gratefully acknowledged. The companies to whom the Bureau is indebted for supplying most of the drilling logs and mine maps from which project records and maps were prepared include: Eagle-Picher Co., Federal Mining & Smelting Co., National Lead Co., American Zinc, Lead & Smelting Co., Scott Mining Co., Rialto Mining Co., and the Grace Jarrett Mining Co.

HISTORY AND PRODUCTION OF THE TRI-STATE DISTRICT

The first lead mining in the Tri-State district was begun about 1851 near the present Oronogo mine in Jasper County, Mo. By 1857 mines near Joplin were producing several hundred tons of galena a year, and mining was active near Granby in Newton County. Zinc was found associated with the lead in nearly all the mines, but the difficulty of smelting the zinc ore together with the lack of railroad transportation from the mines to possible markets delayed exploitation of the zinc resources until after 1870 when the railroad was extended into southwestern Missouri from St. Louis. A zinc smelter was started at Weir City, Kans., in 1873 and other zinc smelters were erected soon thereafter to serve the district. From then on, development of the mining camps in southwestern Missouri was rapid. Zinc-lead mining in the Kansas part of the Tri-State district followed the discovery of ore near Galena in 1876. A

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lead smelter was built at Galena soon after ore was discovered. Several smelters were active by 1917, following the discovery and development of other mining camps in Kansas. In northeastern Oklahoma mining began about 1891 when the Peoria camp became active. Discoveries of ore at Quapaw in 1897 and at Miami in 1905 preceded the period of greatest activity, which followed discovery of the great zinc-lead ore bodies at Picher, Cardin, and Century in 1914 (6). Because the ore deposits in the Picher-Miami area were richer and more concentrated than those being mined in the older Missouri and Kansas camps, mining activities after 1918 were centered largely in the new area.

For several years the Tri-State district produced more than half the national output of zinc. Peak production was reached in 1926, when 423,800 tons of recoverable zinc and 102,117 tons of recoverable lead were produced. Total output of the district in terms of recoverable metals from 1850 through 1953, compiled from the records of the Missouri Geological Survey, Kansas Geological Survey, Federal Geological Survey, and Federal Bureau of Mines, was 11,332,418 tons of zinc and 2,731,913 tons of lead, with a combined value of $1,949,815,058, based on average yearly market prices of the metals.

TRI-STATE DISTRICT AREA AND ITS GENERAL GEOLOGY

The area in which most of the mining in the Tri-State district has been done covers approximately 1,188 square miles and extends from the Wentworth Camp in Missouri on the east to the Melrose Camp in Kansas on the west; and from Neck City on the North Fork of Spring River on the north to Newtonia, Mo., on the south. The area lies on the northwest flank of the Ozark uplift and slopes generally westward to the valley of Spring River, then rises gently to the west over a divide to the Neosho River in Kansas and Oklahoma. The surface elevation ranges from about 1,200 feet above sea level on the east to 800 feet on the west (fig. 1).

Spring River, flowing south through the western part of the district, is, with its tributaries, the main drainage channel of the area. The present land surface east of Spring River approximates the old unconformity below the Pennsylvanian formations above and the Mississippian rocks below. Many outliers of Cherokee shales and sandstones filling sinkholes and erosion valleys occur throughout the district east of Spring River; this area presenting a typical Karst topography illustrates the solubility of the Mississippian limestones. West of Spring River, the principal surface formation is Cherokee shale, and the topography becomes rolling prairie broken only by the Neosho River and a few meandering creeks that flow into it (fig. 2).

The geology of the Tri-State district has been described in publications of the Missouri Geological Survey (1),[3] the State Geological Survey of Kansas (2), the Federal Geological Survey (3, 4, 5), and G. M. Fowler (6, 7), consulting geologist, Joplin, Mo.

A generalized geologic section of the Tri-State district according to Fowler (8) is shown in table 1.

Sedimentary rock thicknesses ranging from 1,045 to 1,815 below the surface have been recorded in the few deep wells that have penetrated igneous rocks in the district. The strata have a regional dip to the northwest of about 30 feet to the mile.

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[3] Underlined numbers in parentheses refer to citations in the bibliography at the end of this report.

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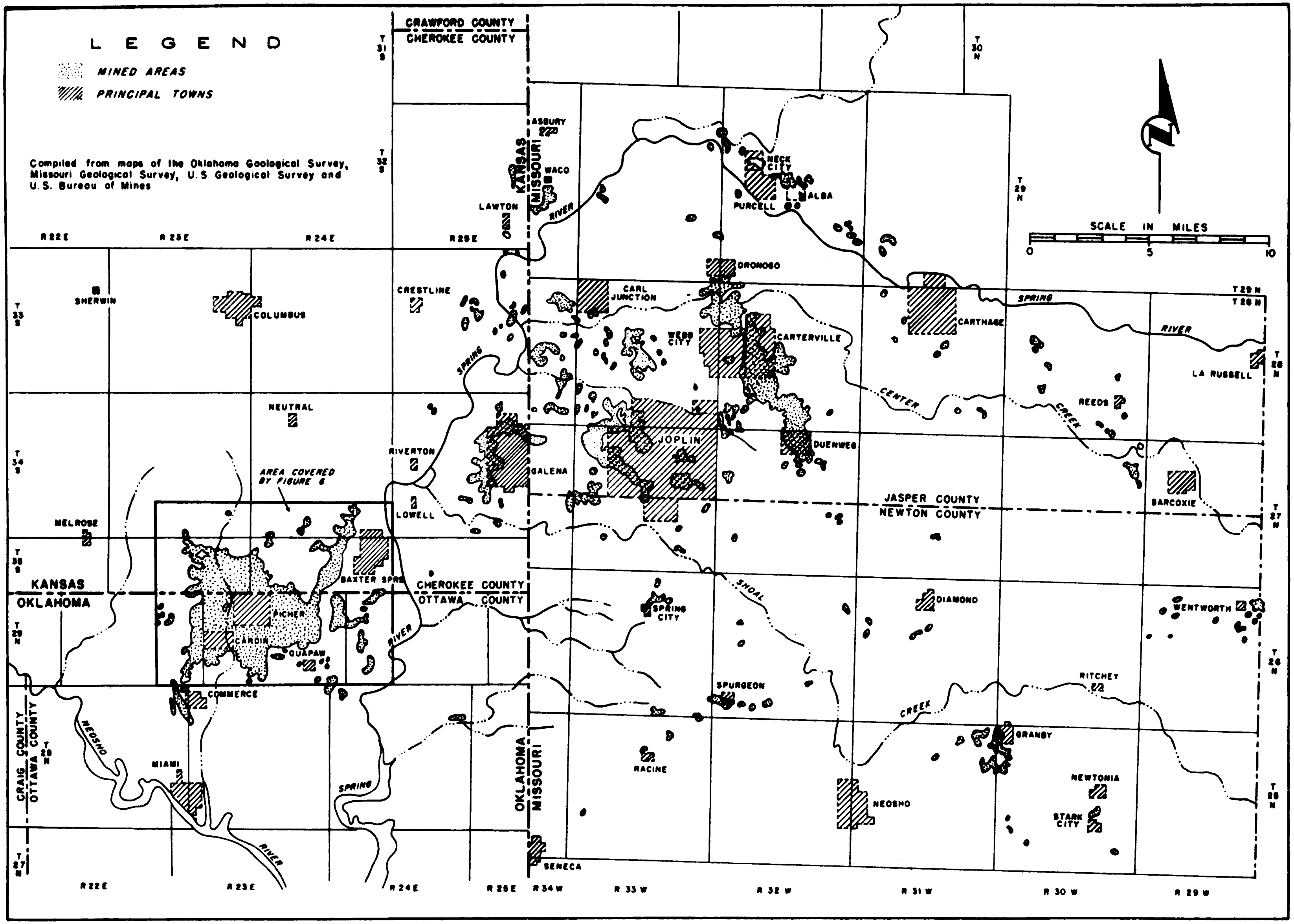

Compiled from maps of the Oklahoma Geological Survey, Missouri Geological Survey, U. S. Geological Survey and U. S. Bureau of Mines

Figure 1. - Principal part of the Tri-State zinc-lead district, showing mined areas.

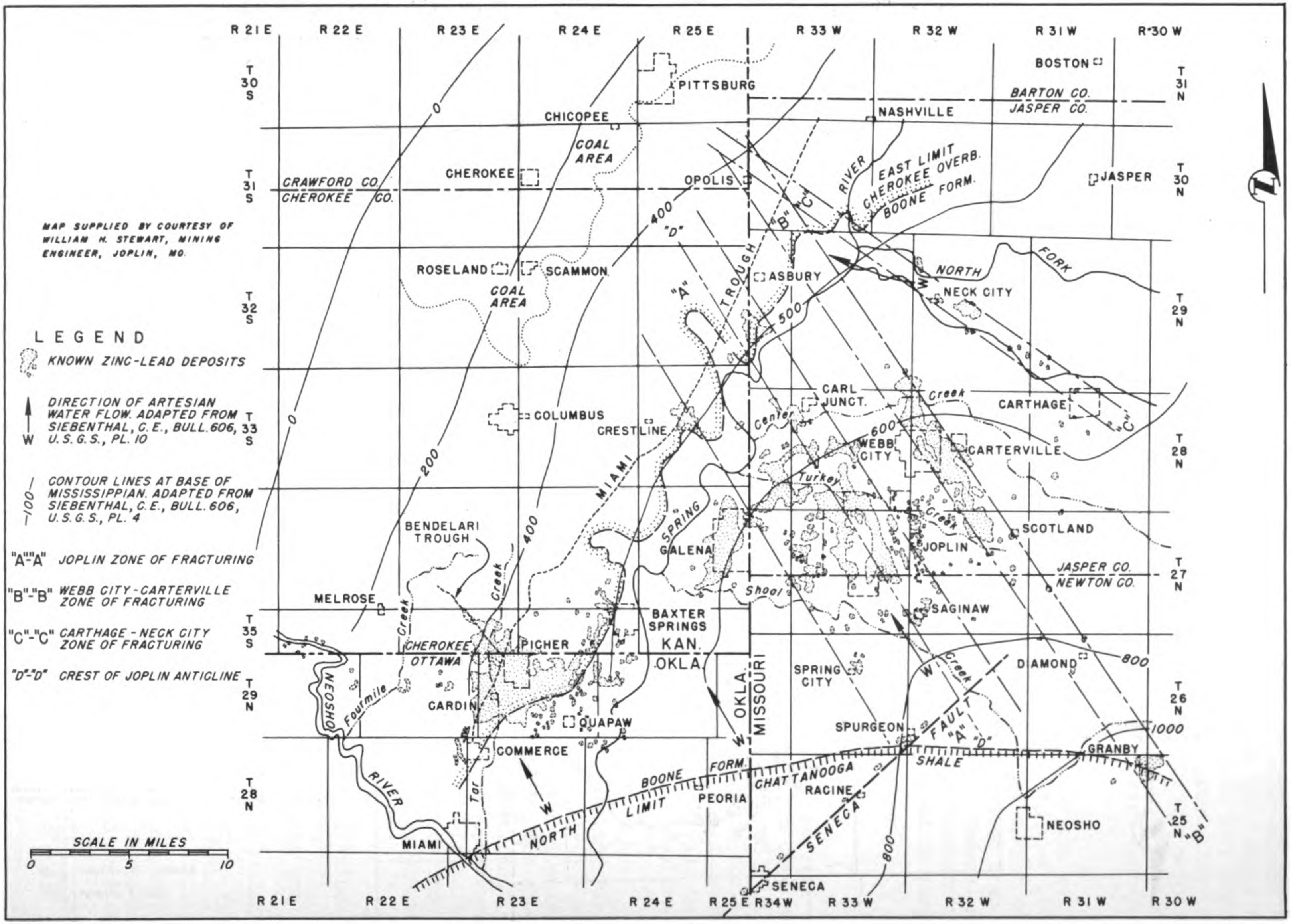

Figure 2. - Map showing principal geologic features of Tri-State district.

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TABLE 1. - Geologic formations in the Tri-State district

Period	Series and character of formations	Thickness, feet
Pennsylvanian......	Cherokee - shale and sandstone.	0 to 300
Mississippian......	Chester - limestone, sandstone, and shale. Occurs as outliers and in scattered sink holes in Missouri. Overlies the Boone in the Oklahoma-Kansas field.	0 to 100
	Boone - limestone, cotton rock, chert, and dolomite - originally all limestone.	100 to 400
	Northview and Chattanooga shales and Compton limestone. Probably absent in most of the district except in southeastern part.	0 to 50
Ordovician.........	Largely dolomite.	70 to 1,000
Cambrian...........	Dolomite and sandstone.	0 to 800
Pre-Cambrian.......	Granite and probably other igneous rock that intruded the granite.	

The ore deposits occur chiefly in strata comprising the Boone formation, but some ore also has been mined in the overlying Chester formation. In the Missouri part of the district, the surface formation is largely Boone, from 100 to 300 feet thick, the upper part having been eroded. In the Oklahoma-Kansas area, the partly eroded Boone is approximately 400 feet thick and is covered with more recent formations, principally Cherokee shale, up to 300 feet thick.

The Boone formation was divided by Fowler (7) into 16 units designated consecutively (I bed omitted), as B to R beds. The correlations are made by examining churn-drill logs, drill cuttings, and underground and surface exposures. Mineralization of the M bed along solution channels and fracture zones and of the O, P, and Q beds, in "sheet ground" mines, has formed the deposits from which most of the ore in the district was produced. The principal ore minerals are sphalerite and galena; associated rock minerals are chert, dolomite, calcite, and jasperoid. In many deposits a form of gouge locally termed "selvage", occurs, especially where deformation and alteration has been intense.

Throughout the district, ore is found only where structural deformation created favorable premineral reservoirs; all the strata are barren elsewhere (8). The most prominent structural feature of the mining region is the Miami trough, an irregular series of fault basins, which follows a northeasterly course for more than 40 miles along the western part of the district. Other prominent structures to which ore mineralization is related include: The Bendelari trough, which trends northwest from the Miami trough at a point near the Kansas-Oklahoma State line; the Joplin anticline with related parallel fractures trending northwest through the Joplin area; and the Seneca fault extending southwestward through Spurgeon, Mo., into Oklahoma (fig. 2).

EXPLORATION AND MINING

Early prospecting was done through shallow shafts, then, as costs became greater owing to increased depth and underground water, churn drilling came into general use. Much of the early exploration was too shallow, as little was known of the ore depth; and much of the record of the early work has not been preserved. Frequent occurrence of ore bodies lying adjacent to shale basins or slumps has led to what is locally termed "shale drilling" designed to locate the contact between the Cherokee shale and the Boone limestone by drilling lines of holes on 200- to 400-foot centers. From the data thus obtained, a contour map of the base of the shale is made, and the area adjacent to the deep shale is prospected by deep drilling.

The drill holes following the westerly dip of the mineralized beds vary in depth from 50 feet or less in the eastern part of the district to 500 feet or more in the western part. Logs of the holes are kept by the drillers, and the drill superintendent or geologist makes his record from the cuttings placed in piles representing successive depth intervals. Depth of shale and marker formations, open ground, water flow, and other data of interest are noted on the driller's log. Drillers classify ore grade according to the following terms, and where samples are not assayed, the equivalent values shown have been found generally satisfactory (10).

Zinc terms	Zinc sulfide, percent	Lead terms	Lead sulfide, percent
Trace zinc................	0.50	Trace lead.................	0.02
Thin zinc shines..........	1.00	Thin lead shines...........	.05
Fair zinc shines..........	1.50	Fair lead shines...........	.25
Zinc shines...............	2.00	Lead shines................	.40
Good zinc shines..........	2.50	Good lead shines...........	.80
Zinc......................	3.00	Lead.......................	1.00
Fair zinc.................	4.00	Fair lead..................	2.00
Good zinc.................	5.00	Good lead..................	3.00
Rich zinc.................	7.50 or better	Rich lead..................	5.00 or better

It should be noted that many of the assays shown on drill logs are in terms of 60-percent zinc sulfide and 80-percent lead sulfide. Other assays are shown in terms of pure sulfides, and in such cases the metal equivalents are 67 percent of the zinc sulfide and 86.6 percent of the lead sulfide content. A few of the companies report assays in terms of metallic content.

Tri-State ores, the lowest grade zinc-lead deposits in the world, have been exploited for over 100 years principally because the ore bodies were large, relatively shallow, and easily mined and milled. Most of the ore was obtained from underground mining operations, although substantial quantities of ore have been mined by opencut methods from shallow deposits in the Missouri part of the district. Underground, the ore bodies are mined by room-and-pillar system, the character of the roof governing the distance between pillars, which generally varies from 20 to 50 feet. From 8 to 15 percent of the excavated area is left in pillars, most of which are removed wholly or in part when mining is finished. In mines where ore occurs in more than one bed and intervening barren beds are strong, the ore bodies are mined on separate levels; in mines where the barren beds are not thick enough to support a level, the entire face is mined, which accounts for some of the headings being 40 to 100 feet from track to roof. Sheet ground deposits vary from 7 to 14 feet in thickness (9). Gross mining, milling, and overhead costs have averaged from $1.50 to $3 per rock ton (7).

Although maps of underground workings and logs of some of the early shallow mining operations probably were not maintained, the operators soon found that it was to their benefit to keep up-to-date mine maps and accurate drill-hole records. These recorded data have proved invaluable in guiding later exploration and development and in locating surface improvements and buildings relative to the workings. Churn-drilling exploration usually provides enough basic data to determine within satisfactory limits the tonnage and grade of zinc-lead ore bodies, on which the value of a prospective mine or mineral property is estimated. The consensus of local mine operators, engineers, and geologists is that over 100,000 holes costing more than $30,000,000 have been drilled in the Tri-State district.

BUREAU OF MINES CATALOG OF RECORDED DRILLING AND MINE WORKINGS

Each land section in the Tri-State district is designated by a reference number beginning with number 1 at the southeast corner of the county and running west to the county boundary line, thence east on the next row of sections to the north to the county boundary line, and continuing in this manner with consecutive numbers until the north tier of sections in each county has been numbered, as shown on figure 3.

The original land and mine maps showing drill-hole locations and mine workings furnished by the operators are drawn on various scales; therefore, they are reproduced on a scale of 200 feet to the inch for including on the standard half-section catalog maps (fig. 4). Standard index sheets giving the coordinate location of each drill hole (fig. 5) are prepared to accompany each half-section map.

Drill-hole logs are microfilmed in the operator's office, thus facilitating the work and obviating the possibility of loss of the records. The Bureau of Mines has copies of 47,500 drill-hole logs on file at the Joplin office and is continuing to accumulate and record all available logs and mine maps in the district. Approximately 28,000 logs have been microfilmed to date.

To May 1, 1954, the mine workings and drill-hole locations in 49 half-sections and 14 fractional sections, covering about 18,100 acres in Cherokee County, Kans., and Ottawa County, Okla., have been recorded and indexed. This represents about 40 percent of the 45,000 acres of explored and developed land within the 760,000 acres that comprise that part of the Tri-State district in which most of the mining has been done (fig. 1). The land tracts and corresponding half-section maps completed to date are shown in figure 6; and data recorded on each half-section map are summarized in table 2. The land tracts on which microfilming of drill-hole logs has been completed are shown in figure 7.

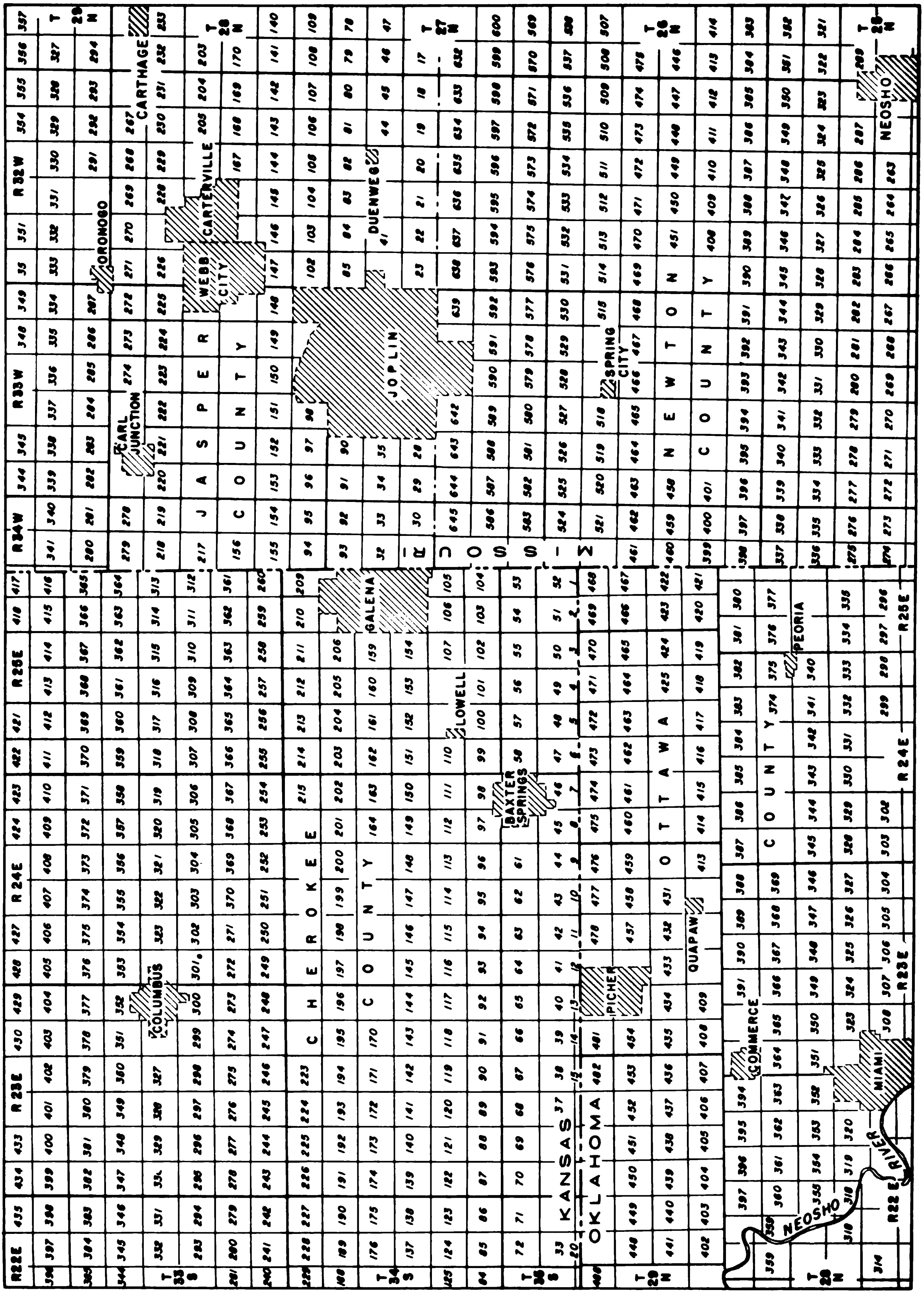


Figure 3. - Index map of section reference numbers.

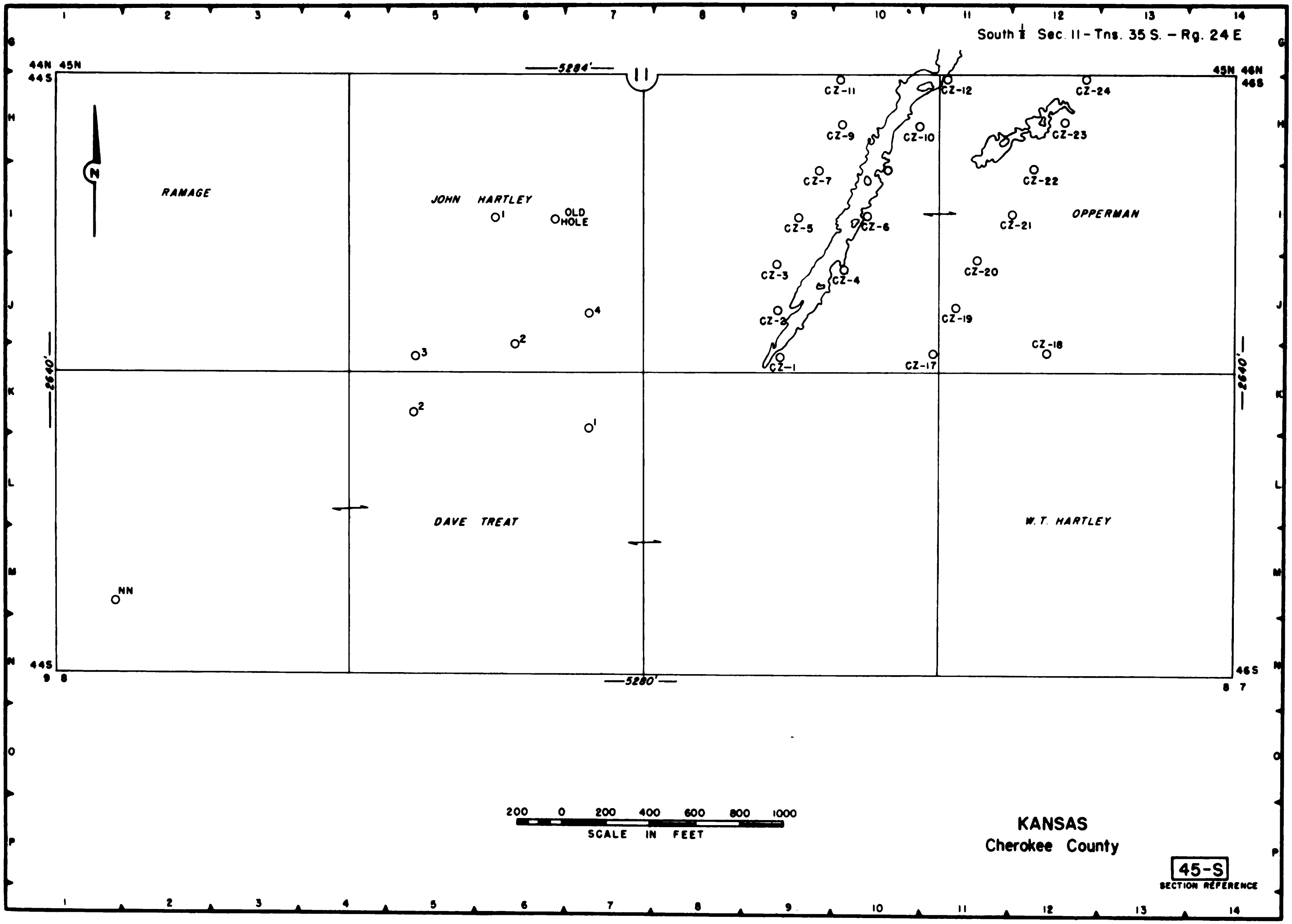
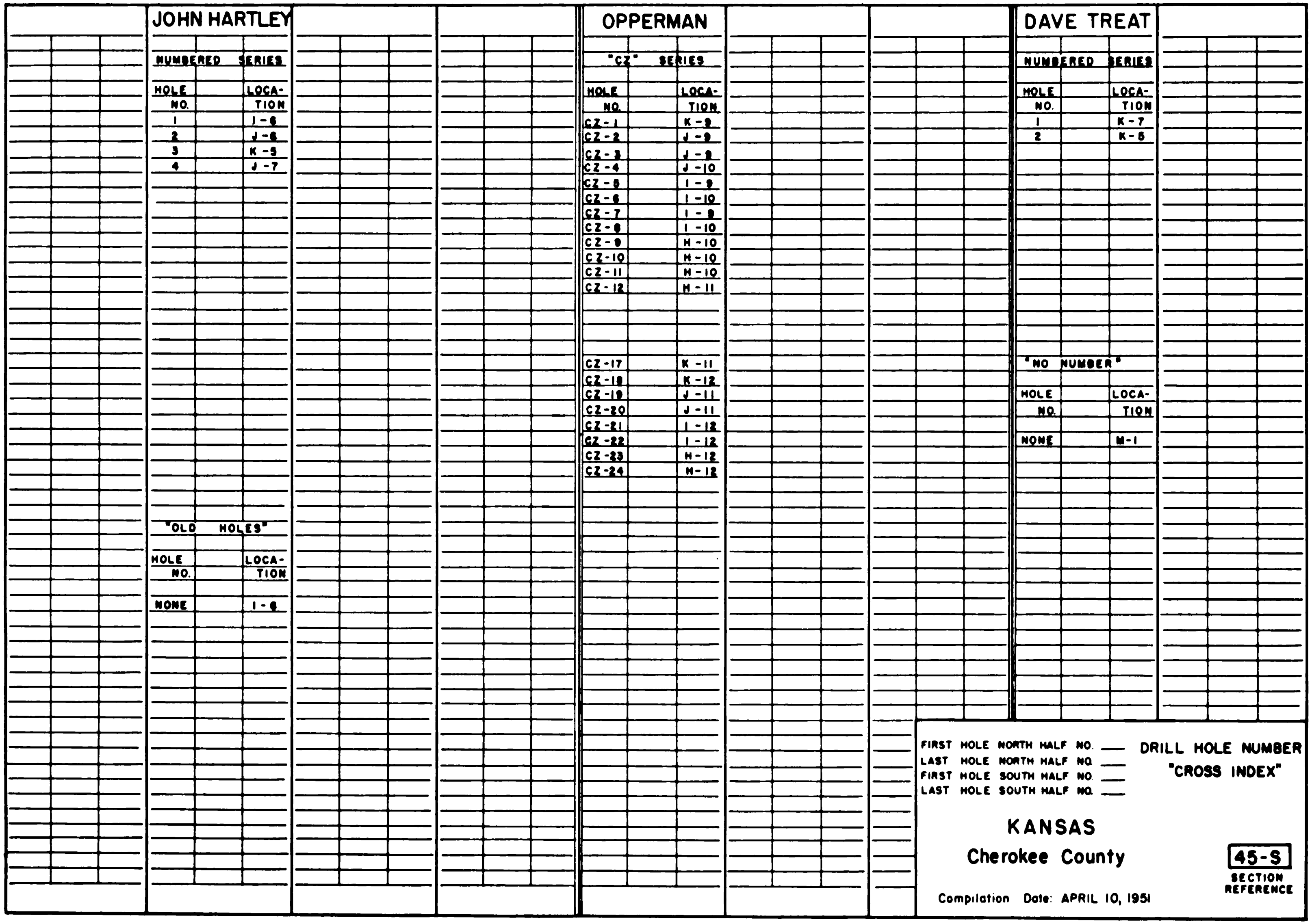


Figure 4. - Standard half section map with mine workings and drill-hole locations.



JOHN HARTLEY

NUMBERED SERIES

HOLE NO.	LOCATION
1	I-6
2	J-6
3	K-5
4	J-7

"OLD HOLES"

HOLE NO.	LOCATION
NONE	I-6

OPPERMAN

"CZ" SERIES

HOLE NO.	LOCATION
CZ-1	K-9
CZ-2	J-9
CZ-3	J-9
CZ-4	J-10
CZ-5	I-9
CZ-6	I-10
CZ-7	I-9
CZ-8	I-10
CZ-9	H-10
CZ-10	H-10
CZ-11	H-10
CZ-12	H-11
CZ-17	K-11
CZ-18	K-12
CZ-19	J-11
CZ-20	J-11
CZ-21	I-12
CZ-22	I-12
CZ-23	H-12
CZ-24	H-12

DAVE TREAT

NUMBERED SERIES

HOLE NO.	LOCATION
1	K-7
2	K-8

"NO NUMBER"

HOLE NO.	LOCATION
NONE	M-1

FIRST HOLE NORTH HALF NO. ___
LAST HOLE NORTH HALF NO. ___
FIRST HOLE SOUTH HALF NO. ___
LAST HOLE SOUTH HALF NO. ___

DRILL HOLE NUMBER
"CROSS INDEX"

KANSAS
Cherokee County

45-S
SECTION REFERENCE

Compilation Date: APRIL 10, 1951

Figure 5. - Standard catalog index sheet showing name of mine, series of drill-hole numbers, and coordinate locations.

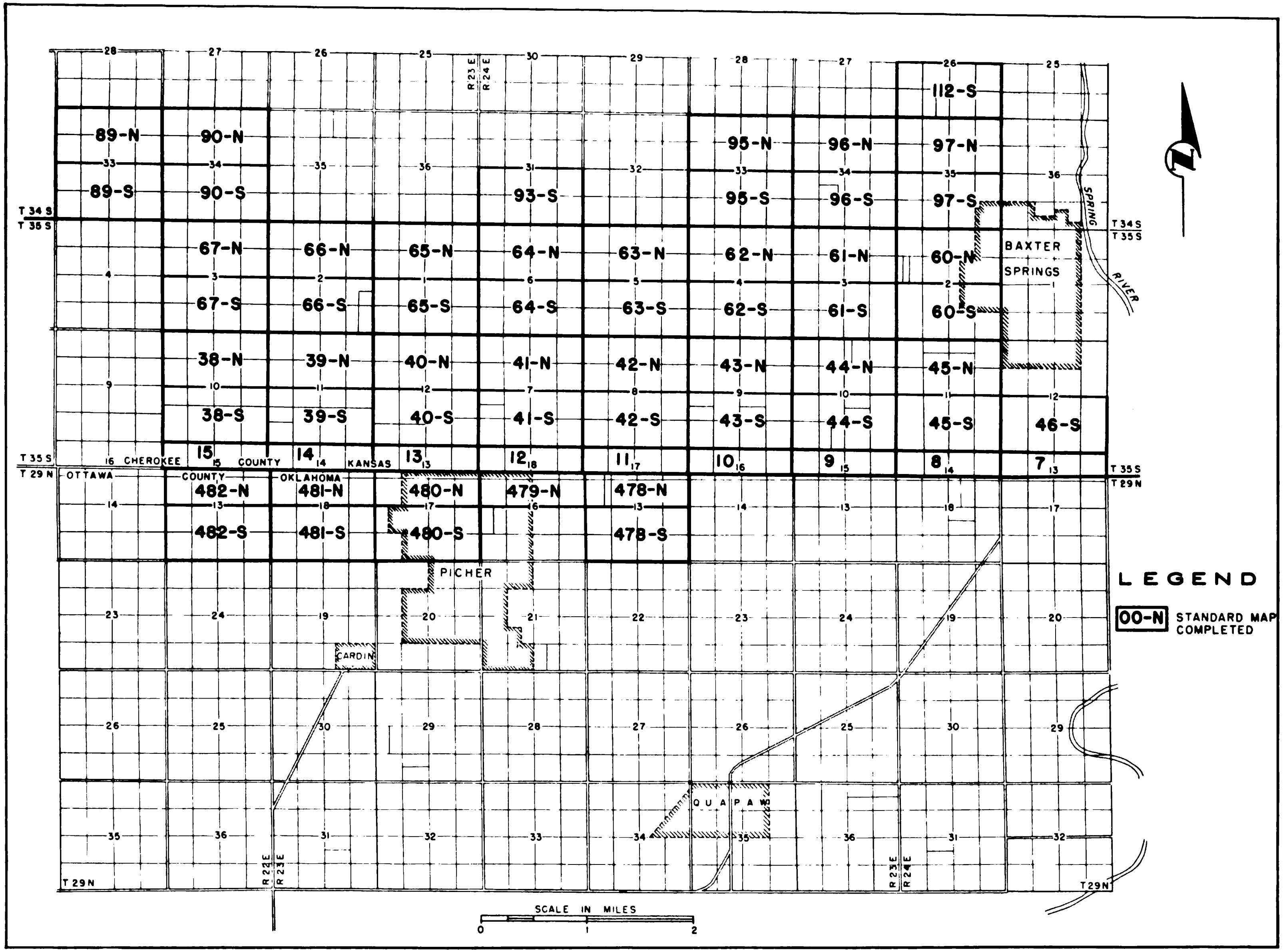


Figure 6. - Progress map showing standard half-section maps completed May 1, 1954.

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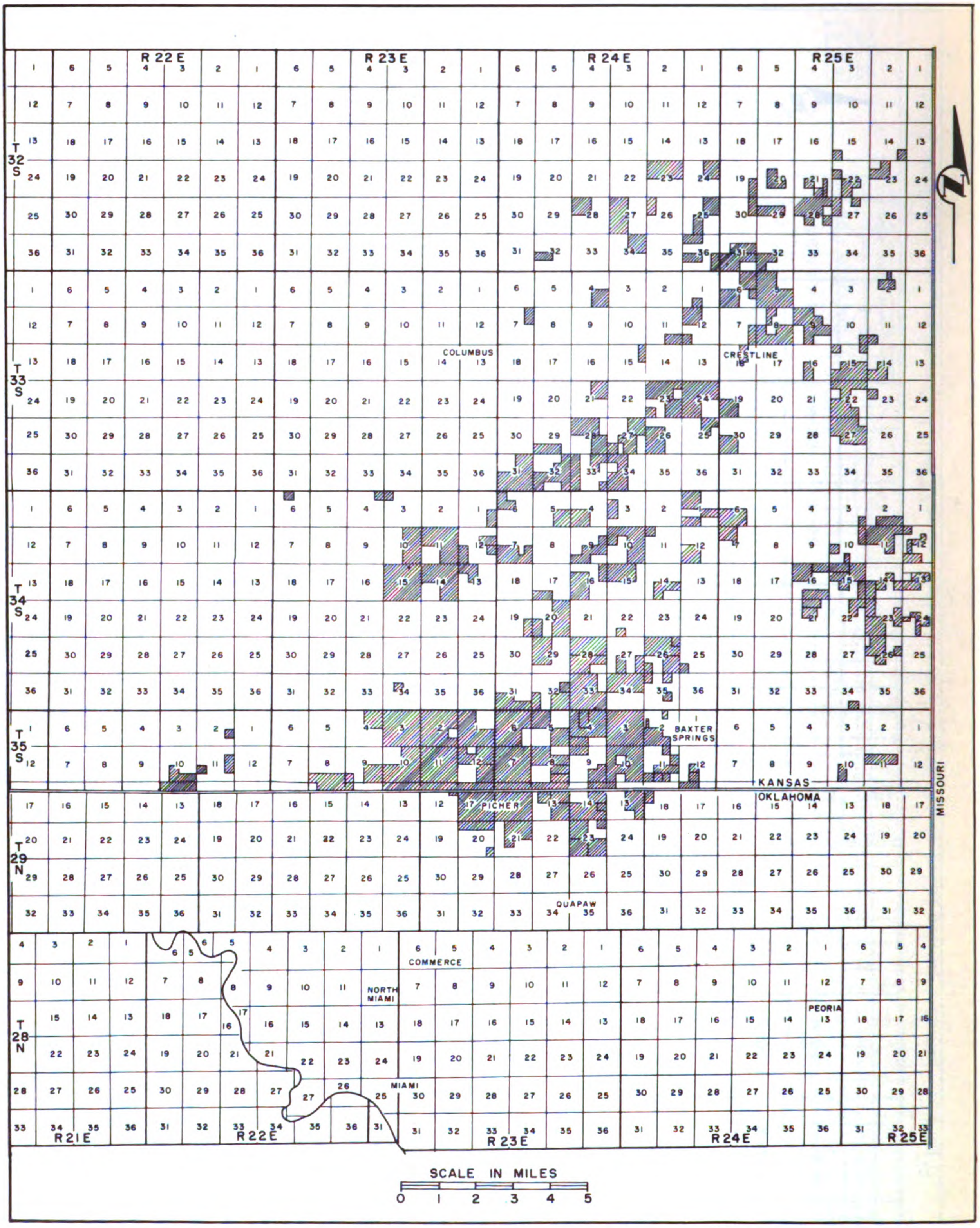

Figure 7. - Land tracts on which microfilming of drill-hole logs was completed May 1, 1954.

TABLE 2. - Data on half-section maps

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
		Cherokee County, Kans. (T. 35 S., R. 24 E.)			
7	Commonwealth Wade	Lot 1, frac. sec. 13	James and Julia Hunter	34.45	-
7	Harrington mine	Lot 2, frac. sec. 13	Rebecca and Julia Hunter	34.40	23
7	Henshaw lease	Lot 3, frac. sec. 13	Ida M. Hull	34.35	2
7	-	Lot 4, frac. sec. 13	do.	34.30	-
8	Beck Royalty Co.	Lots 1 and 2, frac. sec. 14	George W. Beck, Jr.	69.10	23
8	Hartzell	Lot 3, frac. sec. 14	Henry H. Hartzell	34.48	-
8	W. T. Hartley	Lot 4, frac. sec. 14	W. T. Hartley	34.42	-
9	Thomas	Lot 1, frac. sec. 15	R. O Thomas estate	34.78	19
9	Banning	Lots 2 and 3, frac. sec. 15	Merry A. Banning estate	69.40	73
9	-	Lot 4, frac. sec. 15	Mary E. Jackson	34.62	-
10	Stoskopf	Lots 1 and 2 and W-1/4 Lot 3, frac. sec. 16	John Stoskopf	78.75	48
10	Bunker Hill	E-3/4 Lot 3, frac. sec. 16	I.T., T.R., and M. Hocker	26.16	93
10	Lucky "OK" (New Chicago No. 3)	Lot 4, frac. sec. 16	I.T., T.R., and M. Hocker	34.79	156
11	F & G mine	Lot 1, frac. sec. 17	Pearl Lindsey	35.61	142
11	Kansas Line mine	Lot 2 (except NE-1/4 and SW-1/4) and Lot 3, frac. sec. 17	do.	35.45	60
11	John Stoskopf	Lot 2, Lot 3 (except SW-1/4 and NE-1/4), and Lot 4, frac. sec. 17	John Stoskopf	70.71	130
12	Blue Mound mine	Lots 1 and 2, frac. sec. 18	William E. Stoskopf	72.07	311
12	Harris (old E. W. 24)	Lots 3 and 4, frac. sec. 18	Anna Lindsey	71.29	493
		(T. 35 S., R. 23 E.)			
13	New Blue Mound	Lot 1, frac. sec. 13	Louisa Stoskopf estate	35.82	202
13	Blue Diamond	Lot 2, frac. sec. 13	do.	35.72	168
13	Eagle-Picher "Chubb" mine	Lots 3 and 4, frac. sec. 13	D. S. Chubb	71.74	224
14	Boska	Lot 1, frac. sec. 14	A. J., Mary and Clinton Wright, C. E. Russell, and Lester Jarrett	35.86	198

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
14	Mid-Continent (DeArmand)	Lot 2, frac. sec. 14	A. J., Mary and Clinton Wright, C. E. Russell, and Lester Jarrett	35.71	103
14	Eagle-Picher "Wilbur" mine	Lots 3 and 4, frac. sec. 14	F. C., A.L., H.L., and L.C. Wilbur	70.97	213
15	Federal Jarrett	Lots 1, 2, 3, and 4, frac. sec. 15	Gertrude Phillips, N. Adams, and Grace Lewis estate	147.34	147
38N	-	W-1/2 NW-1/4 sec. 10	C. A. Beck	80.00	-
38N	Murphy	E-1/2 NW-1/4 sec. 10	M. F. Murphy	80.00	20
38N	Eagle-Picher "Big John" mine	NE-1/4 sec. 10	Elizabeth Naylor	160.00	206
38S	Griffin	North 55.5 acres SW-1/4 sec. 10	Aaron G. Griffin	55.5	7
38S	A. D. Chubb	SW-1/4 (except north 55.5 acres) sec. 10	Alva D. Chubb	105.8	140
38S	Grace "B" (Consolidated No. 10)	North 55.44 acres SE-1/4 sec. 10	A. J., Mary, and Clinton Wright, and C.E. Russell and Lester Jarrett	55.44	66
38S	Federal Jarrett	SE-1/4 (except north 55.44 acres) sec. 10	Scott and Allen Jarrett, and Dora Bower	105.18	213
39N	Eagle-Picher "Big John" mine	NW-1/4 NW-1/4 sec. 11	Elizabeth Naylor	40.00	132
39N	Eagle-Picher "Black Eagle" mine	NE-1/4 NW-1/4 sec. 11	do.	40.00	173
39N	Eagle-Picher "Tar Creek" mine (Consolidated No. 14)	NW-1/4 NE-1/4 sec. 11	John M. Cooper estate	40.00	170
39N	Eagle-Picher "Early Bird" (Big Elk)	NE-1/4 NE-1/4 sec. 11	do.	40.00	172
39N	Robinson	S-1/2 NW-1/4 sec. 11	T. Robinson, Oliver Jones, and George W. Beck, Jr.	80.00	484
39N	Fox	SE-1/4 NE-1/4 sec. 11	Alfred J. Miller	40.00	206
39N	Eagle-Picher "Tulsa Quapaw" mine	SW-1/4 NE-1/4 sec. 11	A.J., Mary and Clinton Wright, C.E. Russell and Lester Jarrett	40.00	237

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
39S	King Brand	Lot 2 and north 14 acres Lot 3, sec. 11	A.J., Mary and Clinton Wright, C.E. Russell and Lester Jarrett	69.08	255
39S	Eagle-Picher "Tulsa Quapaw" mine	Lot 1, sec. 11	do.	54.88	175
39S	Long Acre	South 38.36 acres Lot 3, sec. 11	do.	38.36	188
39S	Mid-Continent (DeArmand)	Lot 4, sec. 11	do.	52.41	237
39S	Eagle-Picher "Bendelari" mine	Lots 5 and 6, sec. 11	Avery L. Wilbur	104.97	274
40N	Early Bird	W-1/2 NW-1/4 sec. 12	John M. Cooper estate	80.00	96
40N	K. E. Jarrett	E-1/2 NW-1/4 sec. 12	Scott Jarrett	80.00	177
40N	Eagle-Picher "Jarrett" mine	NE-1/4 sec. 12	Scott Jarrett	160.00	338
40S	Kansouri	W-1/2 Lot 2, sec. 12 E-1/2 Lot 2 and north 21.81 acres Lot 3 and north 21.86 acres Lot 4, sec. 12	Avery L. Wilbur Winifred Johnson	27.4) 71.07)	336
40S	Cherokee	South 30.91 acres Lot 3 and south 30.91 acres Lot 4, sec. 12	W. M. Smith estate	61.82	223
40S	Webber	SE-1/4 sec. 12	Alfred H. Ramage	160.00	319
		(T. 35 S., R. 24 E.)			
41N	Eagle-Picher "Foley" mine	NW-1/4 sec. 7	John Foley	160.00	259
41N	Turley	North 60 acres N-1/2 NE-1/4 sec. 7	Luther Turley	60.00	36
41N	Pigg	South 20 acres N-1/2 NE-1/4 and S-1/2 NE-1/4 sec. 7	Ransom Pigg	100.00	54
41S	Eagle-Picher "Barr mine"	S-1/2 NW-1/4 SW-1/4 and SW-1/4 SW-1/4 sec. 7	Eagle-Picher Mining & Smelting Co.	60.00	258
41S	Eagle-Picher "West Side" mine	N-1/2 NW-1/4 SW-1/4 and E-1/2 SW-1/4 sec. 7	Eagle-Picher Mining & Smelting Co.	100.00	254
41S	Little	N-1/2 SE-1/4 sec. 7	do.	80.00	97
41S	Big Yank "Harris"	SW-1/4 SE-1/4 sec. 7	Anna Lindsey	40.00	218
41S	Harris	SE-1/4 SE-1/4 sec. 7	do.	40.00	121
42N	George Stoskopf	NW-1/4 sec. 8	George Stoskopf	160.00	10

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
42N	Leonard Stoskopf	N-1/2 NE-1/4 sec. 8	Opal and Helen Stoskopf	80.00))	62
42N	A. W. Callis	S-1/2 NE-1/4 sec. 8	D. M. Weiss	80.00)	
42S	L. D. Brewster	SW-1/4 sec. 8	L. D. Brewster estate	160.00	-
42S	-	N-1/2 SE-1/4 sec. 8	C. A. Beck	80.00	-
42S	John Stoskopf	S-1/2 SE-1/4 sec. 8	John Stoskopf	80.00	26
43N	Oren Callis	N-1/2 NW-1/4 sec. 9	Charles E. Coe	80.00	36
		N-1/2 SW-1/4 NW-1/4 and N-1/2 SE-1/4 NW-1/4 sec. 9	C. A. Beck	40.00	-
		S-1/2 SW-1/4 NW-1/4 and S-1/2 SE-1/4 NW-1/4 sec. 9	Oren Callis	40.00	4
43N	Otis Everett	NE-1/4 sec. 9	Eagle-Picher Mining & Smelting Co.	160.00	-
43S	Oren Callis	North 53.47 acres SW-1/4 sec. 9	Oren Callis	53.47	-
43S	Otis Everett	W-1/2 SW-1/4 (except north 26.73 acres) sec. 9	Admiralty Zinc Co.	53.08	-
43S	R. O. Thomas	SE-1/4 sec. 9	R. O. Thomas estate	160.00	8
44N	Keith "Robob"	W-1/2 NW-1/4 sec. 10	Eagle-Picher Mining & Smelting Co.	80.00	121
44N	Clark	E-1/2 NW-1/4 sec. 10	C. M. Clark	80.00	218
44N	Slaughter	W-1/4 NW-1/4 NE-1/4 sec. 10	Nancy Slaughter estate	10.00	46
44N	Shanks	E-3/4 NW-1/4 NE-1/4 sec. 10	Eagle-Picher Mining & Smelting Co.	30.00	69
44N	Ballard	S-1/2 NE-1/4 and NE-1/4 NE-1/4 sec. 10	Gertrude and Roy Mitchelson estate	120.00	137
44S	Iron Mountain	N-1/2 SW-1/4 sec. 10	Charles D., Bernice, and Howard Thomas estate	80.00	296
44S	Euterpe	SW-1/4 SW-1/4 sec. 10	Charles D., Bernice, and Howard Thomas estate	40.00	107
44S	Peru	SE-1/4 SW-1/4 sec. 10	do.	40.00	151
44S	Ballard	North 26.02 acres NW-1/4 SE-1/4 and north 35 acres NE-1/4 SE-1/4 sec. 10	Gertrude and Roy Mitchelson estate	61.02	35
44S	Bailey	South 13.98 acres NW-1/4 SE-1/4 and SW-1/4 SE-1/4 sec. 10	W. L. Bailey	53.98	61
44S	Ballard	South 5 acres NE-1/4 SE-1/4 and SE-1/4 SE-1/4 sec. 10	Mary E. Jackson	45.00	4

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
45N	Van Glider	NW-1/4 NW-1/4 sec. 11	R. Van Glider	40.00	14
45N	Hartley	N-1/2 NE-1/4 NW-1/4 sec. 11	W. C. Hartley	20.00	-
45N	Sonny Boy	N-1/2 NW-1/4 NE-1/4 sec. 11	E. L. Mahon	20.00	82
45N	Hartley-Grantham	S-1/2 NE-1/4 NW-1/4 and S-1/2 NW-1/4 NE-1/4 sec. 11	Park Hartley and J. W. Grantham	40.00	44
45N	Beck No. 3	NE-1/4 NE-1/4 sec. 11	-	40.00	77
45N	Ramage	S-1/2 NW-1/4 sec. 11	Alfred H. Ramage	80.00	33
45N	Childress-Grantham	SW-1/4 NE-1/4 sec. 11	do.	40.00	28
45N	Opperman	SE-1/4 NE-1/4 sec. 11	John B. Opperman estate	40.00	5
45S	Ramage	NW-1/4 SW-1/4 sec. 11	Alfred H. Ramage	40.00	-
45S	John Hartley	NE-1/4 SW-1/4 sec. 11	John M. Hartley	40.00	5
45S	Opperman	N-1/2 SE-1/4 sec. 11	John B. Opperman estate	80.00	20
45S	Dave Treat	S-1/2 SW-1/4 sec. 11	David and C. E. Treat	80.00	3
45S	-	SW-1/4 SE-1/4 sec. 11	F. C. Edgerton	40.00	-
45S	W. T. Hartley	SE-1/4 SE-1/4 sec. 11	W. T. Hartley	40.00	-
46S	Opperman	NW-1/4 SW-1/4 sec. 12	John B. Opperman estate	40.00	-
46S	-	NE-1/4 SW-1/4 and NW-1/4 SE-1/4 sec. 12	John Cooper estate	80.00	-
46S	-	E-1/2 SE-1/4 sec. 12	Ida M. Hull	80.00	-
46S	Wade	SW-1/4 SW-1/4 sec. 12	James and Julia Hunter	40.00	-
46S	Commonwealth No. 3	SE-1/4 SW-1/4 sec. 12	Rebecca and Julia Hunter	40.00	18
46S	Henshaw	SW-1/4 SE-1/4 sec. 12	John Cooper estate	40.00	-
60N	Homestake	NW-1/4 NW-1/4 sec. 2	Sue M. Hartley estate	40.00	148
60N	Youse	W-1/4 SW-1/4 NW-1/4 sec. 2	do.	10.00	28
60N	Stoskopf	East 10 acres W-1/2 SW-1/4 NW-1/4	do.	10.00	18
60N	Dines Hartley	E-1/2 SW-1/4 NW-1/4 sec. 2	do.	20.00	50
60N	Clara Jane	E-1/2 NW-1/4 sec. 2 W-1/2 SW-1/4 NE-1/4 sec. 2	W. T. Hartley City of Baxter Springs	80.00) 20.00)	201
60N	Race Track	W-1/2 NW-1/4 NE-1/4 sec. 2	do.	20.00	77
60N	Covert	E-1/2 NW-1/4 NE-1/4 sec. 2	do.	20.00	5

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TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
60N	-	E-1/2 NE-1/4 and E-1/2 SW-1/4 NE-1/4 sec. 2	City of Baxter Springs	100.00	-
60S	Hartley	SW-1/4 sec. 2	M.R., R.W., Walter and R.F. Hartley	160.00	330
60S	Park Hartley	NW-1/4 SE-1/4 (except city tracts) sec. 2	Park Hartley	34.00	98
60S	Sonny Boy	SW-1/4 SE-1/4 sec. 2	E. L. Mahon	40.00	47
60S	Beck No. 3	S-3/4 SE-1/4 SE-1/4 sec. 2	-	30.00	39
60S	-	NE-1/4 SE-1/4 and N-1/4 SE-1/4 SE-1/4 sec. 2	-	50.00	-
61N	Beck Swalley	NW-1/4 NW-1/4 NE-1/4 and W-1/2 N-1/4 SW-1/4 NE-1/4 sec. 3	William and Edward Swalley	205.00	304
61N	Smith	W-3/4 (except W-1/2 N-1/4) SW-1/4 NE-1/4 sec. 3	George A. Smith	25.00	57
61N	Putterbaugh	E-1/4 SW-1/4 NE-1/4 sec. 3	Eagle-Picher Mining & Smelting Co.	10.00	12
61N	Leopard	E-1/2 NE-1/4 sec. 3	do.	80.00	271
61S	M. E. Coe	W-1/2 SW-1/4 sec. 3	Sam T. Coe	80.00	81
61S	Hartley	NE-1/4 SW-1/4 sec. 3	W.C., M.R., and R.W. Hartley	40.00	28
61S	do.	NW-1/4 SE-1/4 sec. 3	do.	40.00	161
61S	Liza Jane	N-1/2 NE-1/4 SE-1/4 sec. 3	Fred Estes	20.00	52
61S	English "O"	SE-1/4 SW-1/4 sec. 3	Charles L. Opperman	40.00	94
61S	Moore	SW-1/4 SE-1/4 sec. 3	Robert H. Moore	40.00	124
61S	Hartley	S-1/2 NE-1/4 SE-1/4 and SE-1/4 SE-1/4 sec. 3	W.C., M.R., and R.W. Hartley	60.00	256
62N	Coe	W-1/2 NW-1/4 sec. 4	Charles E. Coe	80.00	17
62N	Earl Coe	E-1/2 NW-1/4 sec. 4	do.	80.00	10
62N	Swalley "D"	NE-1/4 sec. 4	William and Edward Swalley	160.00	134
62S	Charles E. Coe	N-1/2 SW-1/4 sec. 4	Charles E. Coe	80.00	32
62S	Swalley "E"	N-1/2 SE-1/4 sec. 4	William and Edward Swalley	80.00	5
62S	P. D. Hartley	SW-1/4 SW-1/4 sec. 4	Park Hartley	40.00)	10
62S	Swalley	SE-1/4 SW-1/4 sec. 4	Charles E. Coe	40.00)	
62S	do.	SW-1/4 SE-1/4 sec. 4	William and Edward Swalley	40.00	-
62S	do.	SE-1/4 SE-1/4 sec. 4	Millie L. Chubb	40.00	-
63N	John Foley	NW-1/4 sec. 5	John Foley estate	160.00	2
63N	Leonard Chubb	NE-1/4 sec. 5	Leonard L. Chubb	160.00	-
63S	Velma Thomas	N-1/2 SW-1/4 sec. 5	J. B. Thomas	80.00	-
63S	George Stoskopf	S-1/2 SW-1/4 sec. 5	C. B. Roadarmel	80.00	-

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
63S	William Swalley	W-1/2 SE-1/4 sec. 5	William Swalley	80.00)	42
63S	Edward Swalley	E-1/2 SE-1/4 sec. 5	Edward Swalley	)	
64N	Alva D. Chubb	NW-1/4 sec. 6	Alva D. Chubb	160.00	37
64N	MacArthur	West 25 acres NW-1/4 SE-1/4 and W-1/2 SW-1/4 NE-1/4 sec. 6	T. J. Embree estate	45.00)	119
64N	do.	East 15 acres NW-1/4 SE-1/4, E-1/2 SW-1/4 NE-1/4 and NE-1/4 NE-1/4 sec. 6	J. W. Grantham estate	75.00)	
64N	do.	SE-1/4 NE-1/4 sec. 6	D.S. Chubb estate	40.00)	
64N	Mullen	SW-1/4 sec. 6	Bessie M. Lambert, Jessie P. Cooper, and Anna M. Scammon	160.00	116
64S	John Foley	W-1/2 SE-1/4 sec. 6	John Foley estate	80.00	20
64S	J. B. Thomas	E-1/2 SE-1/4 sec. 6	J. B. Thomas	80.00	8
		(T. 35 S., R. 23 E.)			
65N	John M. Cooper	NW-1/4 sec. 1	John M. Cooper estate	160.00	19
65N	W. B. Davies	W-1/2 NE-1/4 sec. 1	W. B. Davies	80.00	2
65N	M. B Hileman	E-1/2 NE-1/4 sec. 1	M. B. Hileman estate	80.00	5
65S	Southern	SW-1/4 sec. 1	John M. Cooper estate	160.00	106
65S	W. B. Davies	SE-1/4 sec. 1	W. B Davies	160.00	35
66N	Jarrett	W-1/2 NW-1/4 sec. 2	Scott Jarrett	80.00	12
66N	Yost	E-1/2 NW-1/4 and W-1/2 NE-1/4 sec. 2	Clifford Jarrett	160.00	-
66N	Meeds	E-1/2 NE-1/4 sec. 2	Thomas H. Meeds	80.00	47
66S	Eagle-Picher "Big John" mine	W-1/2 SW-1/4 sec. 2	Elizabeth Naylor	80.00	226
66S	Eagle-Picher "Black Eagle" mine	E-1/2 SW-1/4 sec. 2	do.	80.00	150
66S	Northern (Childress Commonwealth)	NW-1/4 SE-1/4 sec. 2	Thomas H. Meeds	40.00	141
66S	Meeds	NE-1/4 SE-1/4 (except southeast 10 acres) sec. 2	John M. Cooper estate	30.00	16
66S	Muncie	SW-1/4 SE-1/4 sec. 2	do.	40.00	170
66S	Semple "Early Bird" mine	W-1/2 SE-1/4 SE-1/4 sec. 2	do.	20.00	79

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
66S	Southern "Vinegar Hill No. 7" mine	E-1/2 SE-1/4 SE-1/4 and southeast 10 acres NE-1/4 SE-1/4 sec. 2	John M. Cooper estate	30.00	56
67N	Stebbins	NW-1/4 sec. 3	Elva Stebbins	160.00	275
67N	Lucky Jew "Chubb" mine	W-1/2 NE-1/4 sec. 3	Alva D. Chubb	80.00	33
67N	Jarrett	E-1/2 NE-1/4 sec. 3	Scott Jarrett	80.00	38
67S	Parmenter	W-1/2 and SE-1/4 SW-1/4 sec. 3	Thomas L. Parmenter	120.00	56
67S	Lucky Jew	NE-1/4 SW-1/4 and N-1/2 SE-1/4 sec. 3	Alva D. Chubb	120.00	300
67S	Eagle-Picher "Big John" mine	S-1/2 SE-1/4 sec. 3	Elizabeth Naylor	80.00	167
		(T. 34 S., R. 23 E.)			
89N	P. L. Stover	NW-1/4 sec. 33	P. L. Stover	160.00	7
89N	Garrett	W-1/2 NW-1/4 NE-1/4 sec. 33	E. A. Garrett	20.00	-
89N	Classen	E-1/2 NW-1/4 NE-1/4 sec. 33	E. and Anna Classen	20.00	-
89N	Stebbins and Bettigo	NE-1/4 NE-1/4 and S-1/2 NE-1/4 sec. 33	Elva Stebbins and Frank Bettigo	120.00	18
89S	Russell Jarrett	SW-1/4 sec. 33	Russell S. Jarrett	160.00	-
89S	Stebbins and Bettigo	W-1/2 SE-1/4 sec. 33	Elva Stebbins and Frank Bettigo	80.00	18
89S	Claxton and Knight	E-1/2 SE-1/4 sec. 33	Opal Claxton and Jennie Knight	80.00	-
90N	C. E. Botsford	NW-1/4 NW-1/4 sec. 34	C. E. Botsford	40.00	-
90N	Minnie Skinner	SW-1/4 NW-1/4 sec. 34	Minnie M. Skinner	40.00	-
90N	Frank Turrill	E-1/2 NW-1/4 sec. 34	Frank H. Turrill estate	80.00	10
90N	M. T. Bulger	NW-1/4 NE-1/4 sec. 34	M. T Bulger	40.00	-
90N	Owen Foley	NE-1/4 NE-1/4 sec. 34	Owen Foley	40.00	-
90N	Mary C. Bulger	S-1/2 NE-1/4 sec. 34	Mary C. Bulger	80.00	5
90S	Karcher	SW-1/4 sec. 34	Katy and H. G. Karcher	160.00	175
90S	Mary C. Bulger	SE-1/4 sec. 34	Mary C. Bulger	160.00	21
		(T. 34 S., R. 24 E.)			
93S	James O. Chubb	SW-1/4 sec. 31	James O. Chubb	160.00	40
93S	Sparlin	SE-1/4 sec. 31	Christopher C. Sparlin	160.00	57
95N	Stoskopf	SW-1/4 NW-1/4 sec. 33	Herbert Paxson estate	40.00	-
95N	Heffley "Buckshot"	N-1/2 NW-1/4, SE-1/4 NW-1/4, and W-1/2 NE-1/4 sec. 33	G. W. Heffley	200.00	61

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
95N	Swalley	NE-1/4 NE-1/4 sec. 33	Edward and William Swalley	40.00	-
95N	Gates	SE-1/4 NE-1/4 sec. 33	Merrill Polk	40.00	-
95S	Stoskopf	W-1/2 SW-1/4 sec. 33	W. E. Stoskopf	80.00	63
95S	Paxson	E-1/2 SW-1/4 sec. 33	Aaron Paxson estate	80.00	134
95S	Swalley "A" and "B"	SE-1/4 sec. 33	William and Edward Swalley	160.00	172
96S	Newell	NW-1/4 sec. 34	D. N. Newell	160.00	44
96S	Brugger	NE-1/4 sec. 34	Wilibald and Hulda Brugger	160.00	278
96S	Swalley "C"	W-1/2 SW-1/4 sec. 34	William and Edward Swalley	80.00	68
96S	Ebbenstein	W-1/2 SE-1/4, N-1/2 NE-1/4 SW-1/4 and E-1/4 S-1/2 NE-1/4 SW-1/4 sec. 34	J. W. Grantham, C.E.Youse, and E.J.Pratt	105.00	161
96S	Brewster	E-1/2 SE-1/4 sec. 34	L.D. Brewster	80.00	241
97N	Beck	N-1/2 NW-1/4, SW-1/4 NW-1/4 and W-1/2 SE-1/4 NW-1/4 sec. 35	J.W. Grantham and Park Hartley	140.00	272
97N	Johnson	NW-1/4 NE-1/4 sec. 35	Nannie R. Johnson	40.00	-
97N	George W. Beck	NE-1/4 NE-1/4 sec. 35	George W. Beck, Jr.	40.00	-
97N	Hinshaw	W-1/2 SE-1/4 NW-1/4 and SW-1/4 NE-1/4 sec. 35	Toby, Mary, Dean, and Geb Hinshaw	60.00	19
97N	Hartley	W-1/2 SE-1/4 NE-1/4 sec. 35	H. P. Hartley	20.00	-
97N	Bilharz	E-1/2 SE-1/4 NE-1/4 sec. 35	O. W. Bilharz	20.00	-
97S	Brewster	W-1/2 SW-1/4 sec. 35	L.D. Brewster estate	80.00	331
97S	Henshaw	NE-1/4 SW-1/4 and NW-1/4 SE-1/4 sec. 35	Narola H. Houchin	80.00	91
97S	Hartley	W-1/2 NE-1/4 SE-1/4 sec. 35	H. P. Hartley	20.00	-
97S	Lawrence and McNulty	SE-1/4 SW-1/4 and SW-1/4 SE-1/4 sec. 35	Clarence E. Youse estate	80.00	259
97S	-	E-1/2 NE-1/4 SE-1/4 and SE-1/4 SE-1/4 sec. 35	-	60.00	-
112S	Morrison	NW-1/4 SW-1/4 sec. 26	Henry I. Morrison	40.00	-
112S	"HHH" lease	SW-1/4 SW-1/4 and W-1/2 SE-1/4 SW-1/4 sec. 26	do.	60.00	210
112S	Little Otis	NE-1/4 SW-1/4 sec. 26	do.	40.00	12
112S	Lewis	N-1/2 SE-1/4 sec. 26	Tom P. Lewis	80.00	54

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
112S	Skelly	E-1/2 SE-1/4 SW-1/4 and SW-1/4 SE-1/4 sec. 26	W. G. Skelly	60.00	49
112S	Weiss	SE-1/4 SE-1/4 sec. 26	Jennie and Leo Weiss	40.00	-
		Ottawa County, Okla. (T. 29 N., R. 23 E.)			
478N	Shaffer	West 36.675 acres W-1/2 NW-1/4 sec. 15	William Shaffer	36.675	90
478N	Mary Ann	East 11.625 acres W-1/2 NW-1/4, E-1/2 NW-1/4, and W-1/2 NE-1/4 sec. 15	Effie Nicholas	109.425	339
478N	W. M. and W. Brewster	E-1/2 NE-1/4 sec. 15	L.D. Brewster estate	48.3	176
478S	Beck Mining Co. "Wade" mine	NW-1/4 SW-1/4 sec. 15	Beck Milling & Refining Co.	40.00	216
478S	Golden Eagle	NE-1/4 SW-1/4 sec. 15	Effie S. Nicholas	40.00	60
478S	Eagle-Picher "Beck" mine	S-1/2 SW-1/4 sec. 15	Beck Milling & Refining Co.	80.00	546
478S	W. M. and W. Brewster	SE-1/4 sec. 15	L. D. Brewster estate	160.00	711
479S	Eagle-Picher "Swift" mine	West 36.945 acres W-1/2 NW-1/4 sec. 16	Mary Whitebird	36.945	121
479N	Moore No. 2 mine	East 12.135 acres W-1/2 and E-1/2 NW-1/4 sec. 16	do.	61.505	179
479N	Eagle-Picher "Hunt" mine	NE-1/4 sec. 16	Joseph Whitebird	98.15	257
480N	Eagle-Picher "Slim Jim" mine	W-1/2 NW-1/4 sec. 17	Sin-Tah-Hah-Hah	50.32	326
480N	Eagle-Picher "Ohimo" mine	SE-1/4 NW-1/4 sec. 17	do.	40.00	184
480N	Eagle-Picher "LaSalle" mine	NE-1/4 NW-1/4 and W-1/2 NE-1/4 sec. 17	Eagle-Picher Trust Co.	59.76	202
480N	Eagle-Picher "Goodwin" mine	E-1/2 NE-1/4 sec. 17	Eagle-Picher Trust Co.	49.44	130
480S	Eagle-Picher "Lucky Syndicate" mine	N-1/2 SW-1/4 sec. 17	Sin-Tah-Hah-Hah	80.00	292
480S	Eagle-Picher "Buffalo" mine	NW-1/4 SE-1/4 sec. 17	Eagle-Picher Trust Co.	40.00	128
480S	Eagle-Picher "Big Chief" mine	NE-1/4 SE-1/4 sec. 17	do.	40.00	92

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
480S	Eagle-Picher "Piokee" mine	SE-1/4 SW-1/4 sec. 17	Sin-Tah-Hah-Hah	40.00	114
480S	Eagle-Picher "Howe" mine	SW-1/4 SW-1/4 sec. 17	do.	40.00	198
480S	Eagle-Picher "Netta White" mine	SW-1/4 SE-1/4 sec. 17	Eagle-Picher Trust Co.	40.00	144
480S	Eagle-Picher "Crawfish" mine	SE-1/4 SE-1/4 sec. 17	Harry Crawfish	40.00	89
481N	Eagle-Picher "Pelican" mine	NW-1/4 sec. 18	Evelyn Gordon	102.23	299
481N	Eagle-Picher "Gordon" mine	W-1/2 NE-1/4 sec. 18	Commerce Milling & Refining Co.	50.88	72
481N	Eagle-Picher "Whiskbroom" mine	NE-1/4 NE-1/4 sec. 18	M. Beaver	10.6	30
481N	Federal Gordon "Burnham" mine	N-1/2 SE-1/4 NE-1/4 sec. 18	Eagle-Picher Mining & Smelting Co.	20.00	55
481N	Federal Gordon "Tiger" mine	S-1/2 SE-1/4 NE-1/4 sec. 18	do.	20.00	63
481S	Eagle-Picher "Pelican" mine	N-1/2 SW-1/4 sec. 18	A. M. Gardner	80.00	57
481S	Eagle-Picher "Ton-Gah-Hah" mine	S-1/2 SW-1/4 sec. 18	Ton-Gah-Hah Beaver	80.00	249
481S	Federal Gordon "Chicago-Miami" mine	NW-1/4 SE-1/4 sec. 18	Eagle-Picher Mining & Smelting Co.	40.00	104
481S	Federal Gordon "Zinc and Lead" mine	NE-1/4 SE-1/4 sec. 18	do.	40.00	124
481S	Federal Gordon "Walker No. 2" mine	SW-1/4 SE-1/4 sec. 18	Harry Gordon	40.00	120
481S	Federal Gordon "Walker No. 1" mine	N-1/2 SE-1/4 SE-1/4 sec. 18	Eagle-Picher Mining & Smelting Co.	20.00	61
481S	Federal Gordon "Beulah B" mine	S-1/2 SE-1/4 SE-1/4 sec. 18	do.	20.00	70

TABLE 2. - Data on half-section maps (Con.)

Section reference number	Name of property	Land description	Landowner	Area, acres	Number of drill holes mapped and indexed
		(T. 29 N., R. 22 E.)			
482N	Laura J. Zheka "Wilson" mine	NW-1/4 sec. 13	Laura J. Zheka	103.07	107
482N	Eagle-Picher "Bird Dog" mine	NE-1/4 sec. 13	Meh-Hun-Keh-Zhe-Kah-Beaver	103.13	332
482S	Laura J. Zheka "Wilson" mine	N-1/2 SW-1/4 and SE-1/4 SW-1/4 sec. 13	Laura J. Zheka	120.00	15
482S	Garrett	SW-1/4 SW-1/4 sec. 13	Henry Hoffman	40.00	-
482S	Eagle-Picher "Bird Dog" mine	N-1/2 SE-1/4 sec. 13	Meh-Hun-Keh-Zhe-Kah-Beaver	80.00	88
482S	Eagle-Picher "Bob White" and "Mehunka" mines	S-1/2 SE-1/4 sec. 13	do.	80.00	145

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